Vol. 15.] MARCH, 1944. [No. 1.

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NOTES FOR LIBRARIES AND RESEARCH INSTITUTES.

So many requests are received from abroad for parts of the *Agricultural Journal* which were never published that the following list of all issues is given for reference. Attention is directed especially to Volume VII which had only one part:—

Vol.			*Vol.*		
1.	3 numbers,	1928	8.	4 numbers,	1935–7
2.	4 ,,	1929	9.	4 ,,	1938
3.	3 ,,	1930	10.	4 ,,	1939
4.	4 ,,	1931	11.	4 ,,	1940
5.	2 ,,	1932	12.	4 ,,	1941
6.	2 ,,	1933	13.	4 ,,	1942
7.	1 number,	1934	14.	4 ,,	1943

ISSUES OF THE AGRICULTURAL CIRCULAR.

THE following were the numbers and year of issue of the *Agricultural Circular*:—

Vol. 1, 1920, 12 numbers.	Vol. 4, 1923, 1 number.
,, 2, 1921, 5 ,,	,, 5, 1924–5, 2 numbers.
,, 3, 1922, 4 ,,	

As number 4 of Vol. 3 was printed as "Volume 4" and number 1 of Vol. 4 as "Volume 5" it would appear from an inspection of a complete set that Volume 4 comprised only a number 4 and that there were two issues of Volume 5, Part 1.

OLD ISSUES OF AGRICULTURAL BULLETINS.

FREE copies of the following Bulletins are available to Colonial Departments of Agriculture, research institutes and bona fide planters, etc.:—

No.

1. Sisal Hemp in Fiji, 1911.
3. Rhinoceros Beetle in Samoa, 1912.
4. The Banana in Fiji, 1912.
5. Scale Insect on Bananas, 1913.
6. Lemon Grass, 1913.
7. A Mission to Java for a Coleopterous Pest of Bananas, 1914.
8. Coconut Experiments, 1915.
9. Soils of Fiji—I., 1916.
11. Alluvial Soils of Fiji, 1919.
12. Leaf Moth of Coconuts, 1919.
13. Sea Island Cotton, 1920.
14. Transparent Coconut Scale, 1921.
15. Purple Leaf Moth of Coconuts, 1924.
17. Early Nutfall in Coconuts, 1930.
18. Control of Coconut Spike Moth, 1935.
19. Fruit Fly Investigations, 1936.
21. Biological Control of the Rhinoceros Beetle, 1941. Price 1s.
22. An Introduction to the Mosquitoes of Fiji, 1943.
    Fijian Plant Names, 1942. Price 3s. 6d., 4s. and 6s.

Applications should be made to the Librarian, Department of Agriculture, Suva, Fiji.

—EDITOR.

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VOLUME 15, NO. 1, MARCH 1944.

ERRATA—Volume 14, No. 4, December, 1943—

Page 94, paragraph 2, line 9, For "*Ptychomyiar emota*" read *Ptychomyia remota*".

Page 95, paragraph 4, line 4, For "those new species" read "three new species".

Page 102, second article, line 4, For "bettles" read "beetles".

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AGRICULTURAL JOURNAL

ISSUED BY THE
DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 15.] MARCH, 1944. [No. 1.

EDITORIAL.

AN interesting and valuable article is that on the sugar soils of the Rewa mill area by the Senior Chemist in co-operation with officers of the Colonial Sugar Refining Company. Determinations of the lime requirement, hydrogen ion content and available phosphate have been made on 115 soils from this area and the results have been compared with the yields of cane on similar soil types. The data given in the tables show that the pH has no general effect on yield of cane although similar soils give lower yields when the pH falls below 5·5 or is greater than 7·5; peaty soils and soils on hills and shallow lands have the lowest pH values. The tables also show that there is a general tendency for the yield of cane to be depressed as the need for lime increases and statistical analyses shows that there is a fair to moderately good correlation between yield and available phosphate content.

Finally, the data reveal that for pH values between 5·4 and 7·5, the lime requirement can be determined for all practical purposes by a determintion of the pH of the soil. This article is obviously of practical economic value and indicates the benefit of co-operation between workers studying similar problems. The second part of these soil investigations, of which this is Part 3, was published in the *Journal* for September 1942.

The subject of cocoa has not received much attention until very recently, and the possibility of cocoa exports, which have lapsed for many years, is being investigated. This issue contains a summary of a report on surviving cocoa trees in Vanua Levu and Taveuni carried out by the Agricultural Officer North.

Despite neglect for over thirty years some 1,300 trees have survived including some good varieties of Criollo and it should be possible to resuscitate the industry which was abandoned after the hurricane of 1912 and the falling price of cacao consequent on the outbreak of war two years later.

The principal pest is the rat but damage by the flying fox and minor insects is also recorded. There is no record of the two very serious diseases which threaten this crop in the West Indies and in West Africa. The report, which is a preliminary one, is encouraging in that it shows that some of the best cacao has survived despite many years of neglect and it is hoped that yield records and further details may become available in the near future.

In a recent report by Mr. Cadbury, stress was placed on the needs for increasing supplies of cocoa to meet a constantly growing world demand and this crop may yet prove of value to Fiji.

With shipping communications as bad as they are, and seem likely to be in the future, production of local pork is of some importance and the article on the curing of pork shows what can be done if attention is given to frequent inspection with the removal of uncured meat and to thorough deboning of the strips which should not be wider than one to one and a half inches.

The last article on a forestry subject was in our issue for June 1941 and so that on shingle roofs in this issue by the Assistant Conservator of Forests will be read with interest. Careful tests showed that dakua salusalu was the best timber for the purpose which confirms the experience of settlers in the early days of the Colony who preferred to use this wood which makes a roof six to seven times as lasting as thatch and much cooler and more sightly than the beloved corrugated iron of the present day Fijian. As the import of suitable roofing materials is precarious at the present it seems that the time is opportune for a revival of the shingle industry and this article gives details of the few tools required and the best method of preparing the shingles. Permanency of natives' roofs was discussed at the last meeting of Legislative Council.

To most people in Fiji the thrip is regarded as a beneficial insect owing to the check it exercises on Köşter's curse. However, thrips are more usually pests on economic plants as the note on the damage done to lettuce shows. This thrips is new to the Colony and island groups in the Pacific exclusive of Hawaii.

Owing to war conditions many new substances are being manufactured on a large scale for the first time in the Dominions. An example of this is a New Zealand made boot polish which when opened at Lautoka was found to contain live maggots which, it was subsequently proved, were of a species already found in Fiji.

Work on the various fruits attacked by fruit-flies was carried out by the then Entomologist in 1935 and it is interesting to record two new fruits which have since been attacked, viz. bread fruit and jak fruit. Further details on the associated parasites will appear in a later issue.

Certain flattened beetles have adapted themselves to passing their life between the closely pressed leaflets or " fronds " of coconut and other palms. A note clears up the nomenclature of the most serious pest of coconut plantations in Melanesia.

The commoner crickets of the Colony are next dealt with one being found only where it is all but bathed in spray from water-falls or on moist boulders and another which, though a coconut pest in the Solomons, has yet to be found on that plant in Fiji.

The addition of another mosquito to our fauna is always interesting and the account of *Aëdomyia* extends the range of this well known Australian and Oriental mosquito to Fiji. Some of the less common mosquitoes of Fiji are also dealt with.

Besides the longer article there are eight notes by the Senior Chemist ranging from derris and shark and chaulmoogra oils to the identification of pilfered petrol which has become a familiar practice to some light-fingered drivers wishing to enhance their normal ration by unfair means.

A note of practical importance on the costs of copra production shows that allowing for all contingencies the cost " on the beach " worked out at £9 6s. per ton last December. Comments on the various items given is welcomed from planters who will be able to supply their own costs. As the total tonnage of copra may not be given for security reasons the copra grading note is very brief.

Fresh produce to the military forces in 1943 is seen to have reached over 15½ million lb to the value of £90,000. It will be noticed that Fijians supplied 90 per cent of the root crops, Indians 45 per cent of the vegetables and Chinese 35 per cent.

Rock melons are always a favourite purchase when they appear on the market and the article on this crop grown at the General Experiment Station

shows what a profit it can bring even allowing for the application of artificial manure.

Anything which helps to maintain the health of poultry is of importance even although the fixed price of eggs has been reduced recently from 4s. to 3s. 6d. per dozen, retail. A note on a bloodsucking mite which has been causing a good deal of annoyance to poultry in the Nadi District is worth attention.

The giant toad, introduced in 1936 to eat insect pests of gardens and cane fields, has recently been found to play havoc with hive bees and although apiarists are very few in the Colony it is well to give prominence to this unfortunate trait of the toad.

The rainfall for last year was just over 88 inches which contrasts with 1941 when it reached a total of 143·7 inches, the highest since 1939.

Due to the need for stressing food production owing to the increased military establishment it has not been possible to provide plant material for sale for the last few years. A note draws attention to the fact that limited supplies of such plants are now available though things have to be built up again from almost nothing.

In the last issue of the *Journal* invitations were made for anyone willing to plant seeds of chaulmoogra oil trees and further developments of this scheme are given.

Two obituaries are published, one of a distinguished entomologist, Sir Edward Poulton who always took a great interest in butterflies of the Pacific and the other obituary concerns Mr. R. B. Howard who died at the ripe age of 96 after having devoted many years to the introduction of new plants and grasses into the Colony.

ECONOMIC AND ORNAMENTAL PLANTS FOR SALE.

For the past two to three years labour difficulties and the necessity for the concentration of staff on vegetable production and marketing for the Forces have necessitated the operation of Departmental ornamental and other nurseries on a very small scale only. With local conditions returning somewhat to normal it now becomes possible to recommence this service and members of the public are advised that orders for ornamental and other plants will again be accepted. As the nurseries have to be built up again almost from nothing the delivery of plants may be considerably delayed.

Orders may be placed with the Director of Agriculture, Suva, or preferably with the Agricultural Officer, Southern, Naduruloulou—Telephone No. Nausori 16, 4 rings.

Charges have been fixed as under:—

Budded citrus plants—1s. each.
Seedlings of any kind—3d. to 6d. each according to species or variety.
Cuttings—1s. per bundle.
Seeds—3d. to 6d. per packet.
Dwarf coconuts (red, yellow or green)—4d. each for germinated nuts.

As difficulty is experienced in arranging the carriage of plants outside Suva, orders from country districts should be accompanied by instructions for delivery to a transport or other agency in Suva who can accept delivery and forward the plants as required.

SOIL INVESTIGATIONS—PART 3.

THE SUGAR-CANE SOILS OF REWA.

By
W. J. BLACKIE, M.Sc., F.I.C., F.N.Z.I.C.,
Senior Chemist, Fiji.

An area of approximately 11,000 acres is devoted to the growing of sugar-cane on the alluvial flats and contiguous soils in relation to the lower Rewa River and its tributary system.

The area concerned has a high average annual rainfall of some 150 inches and, although good yields of cane are obtained on the better class soils, the sugar content of the juice is much lower than that for the drier areas of Viti Levu.

The methods of cultivation are similar on the different estates and, with the exception of the "back lands", similar yields are obtained on soils of similar mechanical composition. The yields on the "back lands" are closely correlated with drainage since although these soils are slightly heavier the differences in mechanical and chemical composition would not be sufficient to account for the depression in the yields.

As an example of the effect of poor drainage on the yield of cane the following two soils from the same area are contrasted:—

Table 1.

	Fine gravel.	Course sand	Fine sand.	Silt.	Fine silt.	Clay.
	%	%	%	%	%	%
Soil No. 26—Muanaweni ..	0·0	2·0	10·2	17·7	22·7	22·1
Soil No. 25—Muanaweni ..	0·1	6·8	26·7	14·2	20·3	12·1

	Nitrogen	P_2O_5	K_2O	Av. P_2O_5 (P.P.M.)
Soil No. 26—Muanaweni ..	0·17	0·12	0·42	110
Soil No. 25—Muanaweni ..	0·18	0·14	0·47	260

	No. 26.	No. 25.
Cane Yields per acre (Av. 15 years =	23·8 tons	41·5 tons.

The small differences in chemical and mechanical composition are not sufficient to account for the great differences in yield which are due to the poor drainage conditions operating in soil No. 26.

In *Bulletin* No. 11 of the Department of Agriculture Fiji, C. H. Wright(1) discusses the alluvial soils of Fiji and comes to the conclusion that they are all very similar in chemical and mechanical composition.

From the point of view of mechanical composition he defines two types, namely, a loamy type and a sandy type.

The average mechanical composition of these soil types are given as follows:—

Table 2

	Sandy type.	Loamy type.
Moisture	8·2	10·5
Loss on ignition	8·5	10·8
Fine gravel	0·0	0·1
Coarse sand	4·5	4·9
Fine sand	35·2	18·3
Silt	14·3	17·0
Fine silt	17·0	22·9
Clay	11·2	15·6

The average chemical composition of 29 alluvial soils with maximum and minimum values for each constituent is as follows:—

TABLE 3.

	Nitrogen.	Alumina.	Oxide of Iron.	Oxide of manganese.	Lime.	Magnesia.	Potash.	Phospheric acid.	Av. phos. acid ppm.
	%	%	%	%	%	%	%	%	%
Maximum ..	0·25	17·40	13·18	0·52	1·01	1·76	0·65	0·25	760
Average ..	0·19	14·22	8·79	0·22	0·91	0·88	0·33	0·14	250
Minimum ..	0·10	10·34	7·42	0·07	0·52	0·25	0·16	0·07	110

Wright (1) stated that all the alluvial soils were acid to litmus and had a lime requirement, by the Hutchinson and McLennan Method, of from 2·77 to 5·15 tons per acre. Blackie (2) has quoted for alluvial soils acidity figures of from 4·66 to 5·98 as pH and lime requirement figures of from 2·0 to 7·4 tons per acre of soil of 2 x 10^6 lb.

The Colonial Sugar Refining Company has developed a liberal policy in regard to the fertilizer treatment of their soils which is in accord with sound plantation practice in respect to this crop. Organic matter is supplied to the soils in the form of cane trash, mill waste and green manure and artificial fertilizers such as ammonium sulphate, muriate of potash and phosphatic fertilizers are applied at the appropriate season. A local practice which has yielded excellent results on acid cane soils has been the routine addition of calcium carbonate in the form of coral sand.

In order to be better informed in regard to the lime requirement and the available phosphate status of the Rewa Cane Soils, the Colonial Sugar Refining Company carried out a series of soil examinations, and determinations of pH, lime requirement and available phosphates were made on 115 selected soils covering nine sectors of the Rewa Mill area and the results compared with the average yield of cane for the soils concerned. The average data are compiled in Table 4 together with observations on drainage and cultivation. The detailed data are not included in this paper for reasons of economy in printing but can be obtained on application to the Department

TABLE 4.

AVERAGE ANALYSIS OF SOILS AND YIELDS OF CANE ACCORDING TO TYPE OF SOIL.

Type of Soil.	pH	Lime Reqt. cwt./acre.	Available phosphate. %	Yield of cane tons per acre.	Drainage.
River bank—deep alluvial loam ..	6·34	5·7	·0124	30	good.
Good loam with sand, mainly near river bank	6·09	5·9	·0087	29	good.
Medium—heavy loam with clay subsoil	6·13	8·2	·0075	26	variable.
The peat belt—light loam and peat—blue clay subsoil	5·72	16·4	·0131	28	medium.
Stiff loam with clay on central flat ..	5·90	9·5	·0033	20	medium–poor.
Shallow land on sand or clay . ..	5·47	14·3	·0039	15	poor.
Hill land—shallow loam on red clay	5·43	15·5	·0024	20	good.

NOTE.—pH figures are average of hydrogen ion concentration.

The pH was determined electrometricly by means of the quinhydrone electrode, the lime requirement by the Hutchinson and MacLennan method and the P_2O_5 by the Arrhenius modification of the Dyer citric acid technique.

The results of this analysis in comparison with values obtained previously—see Wright (1) indicate that:—

(1) the pH of the soils of the Rewa cane areas have been greatly improved;
(2) the lime status of the Rewa cane soils has been markedly improved;
(3) the available phosphate status of the Rewa cane soils is below the minimum figure recorded by Wright (1).

The general trend of the figures in Table 4 seems to indicate that yield increases with decreasing lime requirement and further, that yield is associated with the available P_2O_5 status of the soil.

The product moment correlation coefficient between any two series is based on the formula—

$$r = \frac{\text{the sum of } xy}{\text{the square root of (the sum of } x^2 \text{—the sum of } y^2)}$$

and the probable error of the correlation co-efficient is given by—

$$\frac{0{\cdot}6745\ (1-r^2)}{\text{the square root of } n}$$

where x and y are the differences from the respective means of the two groups being compared and n = number of soils.

In contradistinction to Wright (1), seven types of soil were recognized in the field and are described thus:—

(1) River bank deep alluvial loam.
(2) Good loam with sand, mainly near river.
(3) Medium–heavy loam with clay about 10 inches below surface.
(4) The peat belt—light loam with peat mixture—blue clay subsoil.
(5) Stif loam with clay. Mainly on central flat.
(6) Shallow land. Mainly stiff clay—on flat.
(7) Hill land. Shallow loam on red clay.

Examination of Data.

A statistical analysis of the data for all the soils irrespective of type gave the following results:—

Average pH = 6·22. Standard deviation (s) = $\pm$ 0·29 pH.

Average lime requirements = 9·39 cwt. per acre. Standard deviations (s) = $\pm$ 5·83 cwt. per acre.

Average available P_2O_5 = 68·45 ppm. Standard deviation (s) $\pm$ 26 ppm.

Average yield = 23·72 tons per acre. Standard deviation (s) = $\pm$ 7·08 tons per acre.

Comparing the lime requirement and available P_2O_5 separately with the yield on each soil type suitable for the growth of cane the following values for r were obtained—

(1) River bank deep alluvial loam:—	
Average P_2O_5 and yield	$r = 0{\cdot}70 \pm 0{\cdot}09$
Lime requirement and yield ..	$r = 0{\cdot}74 \pm 0{\cdot}06$
Number of soils, n.	20
(2) Good loam with sand near river:—	
Average P_2O_5 and yield	$r = 0{\cdot}52 \pm 0{\cdot}13$
Lime requirement and yield ..	$r = 0{\cdot}55 \pm 0{\cdot}13$
Number of soils, n	13

(3) Medium-heavy loam with clay about 10 inches below surface:—

Average P_2O_5 yield	$r = 0{\cdot}47$	$\pm$ 0·09
Lime requirement and yield ..	$r = 0{\cdot}57$	$\pm$ 0·04
Number of soils, n	31	

(5) Stiff loam with clay. Mainly on central flat:—

Average P_2O_5 and yield	$r = 0{\cdot}58$	$\pm$ 0·08
Lime requirement and yield ..	$r = 0{\cdot}71$	$\pm$ 0·06
Number of soils, n	28	

(7) Hill land. Shallow loam on red clay:—

Average P_2O_5 and yield	$r = 0{\cdot}61$	$\pm$ 0·02
Lime requirement and yield ..	$r = 0{\cdot}71$	$\pm$ 0·11
Number of soils, n	8	

Since a correlation coefficient of one indicates perfect correlation it is evident that correlation is not generally good; however, in the case of (1) River bank deep alluvial loam and (7) Hill land shallow loam on red clay, there is a moderately good inverse correlation between lime requirement and yield and a positive correlation between available P_2O_5 and yield. Also there is a similar, moderately good correlation (inverse) between lime requirement and yield in the case of (5) Stiff loam with clay, mainly on central flat.

The other soil types show correlation tendencies but it is evident that variable factors outside the control of the experiment are contributing as much to general fertility as are the lime and available P_2O_5 factors.

Summary.

An examination of the data shows that—

(1) The pH of the Rewa cane soils has no specific effect on cane yield although similar soils give lower yields when the pH falls below 5·5 or is greater than 7·5; further, peaty soils, shallow hillside soils and shallow soils generally have low pH values (high acidity);

(2) There is a general tendency for the yield of cane to be depressed as the need for lime increases;

(3) There is a fair to moderately good correlation of yield with available P_2O_5 and finally,

(4) The lime requirement of the Rewa cane soils can be measured for all practical purposes by a determination of pH between the values 5·6 to 7·5.

The Department is indebted to the Attorney of the Colonial Sugar Refining Company for permission to use the data which were compiled by Mr. Trivett of that Company and the Chemists under his direction.

References.

(1) Wright, C. H. 1919—Alluvial Soils of Fiji, *Bulletin* 11, Dept. of Agric. Fiji.
(2) Blackie, W. J. 1937—The Lime Requirement of Fijian Soils, *Agric. Journ.*, Dept. of Agric. Fiji, Vol. 8, No. 3, p. 33.

CHAULMOOGRA SEED.

Only four inquiries have been received to date in response to a suggestion in the last issue of this Journal that many planters and others might be prepared to plant up a few *Hydnocarpus* trees for the supply of fruit to Makogai Leper Station. This note is published as a reminder that seed for planting can be obtained on application to the Agricultural Officers, Southern at Naduruloulou, or Western at Sigatoka.

SUMMARY OF A PRELIMINARY SURVEY OF EXISTING CACAO IN THE NORTHERN DISTRICT, FIJI.

By
M. D. FFRENCH-MULLEN, D.I.C.T.A., A.I.C.T.A.
Agricultural Officer Northern.

This survey was undertaken to determine the general conditions of growth and the varieties of existing cacao in the Northern District as well as the possible reasons for the abandonment of the industry.

The Northern District comprises the islands of Vanua Levu and Taveuni together with smaller ones, the whole lying between 16° to 17° south latitude. Vanua Levu is divided by a mountain range through its long axis which roughly divides the island into the wet and dry zones, the wet zone being situated on the windward or south-eastern side of the range. The temperature varies from 10° to 12° F. annually; the prevailing winds are the south-east trades. The soils on which the crop occurs vary from alluvial river flats with medium to perhaps heavy clay contents in the main to brown earths on hill slopes formed *in situ* and being originally under secondary forest.

Towards the close of the nineteenth century and in the first decade of the twentieth a small cacao industry was started but was abandoned about 1912. The survey was carried out on the surviving plantings which have been thus abandoned for over thirty years.

Cacao was planted in fourteen places of which ten were situated in the wet zone and the remainder in the dry. No cacao has survived in two of the places. The places in which cacao was originally planted are listed as follows:—

Cakaudrove Province—

Mount Vernon Estate, Taveuni.
Naidi Estate, Savu Savu.
Valaga Estate, Savu Savu Bay.
Denua Homestead, Savu Savu Bay.
Waiwai Estate, Savu Savu Bay.
Waibalabala Estate, Savu Savu Bay.
Dawara Village, Yanawai River.

Bua Province—

Sawai Estate, Kubulau.
Dawadigo Estate, Wainunu River.
Davutu Estate, Wainunu River.
Delainasau Estate, Lekutu River.

Macuata Province—

Natondra Estate, Dreketi River.
On or near Mataikavatu Estate, Dreketi River.
Tabea, Namuka Creek.

Elsewhere in the Fiji Group, cacao is recorded as occurring at Levuka in Ovalau, at Nasinu, Lami and Ra in Viti Levu and in Rotuma. A few seedlings obtained from pods forwarded from estates in Savu Savu Bay in 1942 were planted at Naduruloulou in Viti Levu and at Savudrodro in Vanua Levu.

No written records were available of the origin of the planting material, the development of the industry or the reason for the abandonment of the crop. The history of the industry was compiled from information willingly supplied by old residents including those who were concerned with the establishment of the crop in Vanua Levu in the Wainunu and Savu Savu Bay areas between 1900 and 1912.

Cacao appears to have been first planted in the Dreketi river area in the last century as well as on the alluvial flats of the Yanawai river. In 1901 to 1902 cacao was established in the Wainunu river area followed by plantings in the Savu Savu Bay area between 1908 to 1912. Plantings were made either in pure stand under planted shade or interplanted with rubber and coconuts. The industry was abandoned in 1912 as a result of a severe hurricane which extensively damaged the crop resulting in the discouragement of planters. Other contributing causes were probably the greater attraction of coconut planting, the price of cacao and general unsettlement owing to the outbreak of the Great War. The failure of plantings in the four localities in the dry zone were due to definitely unsuitable ecological conditions.

The existing cacao population was found to be made up of Criollo and Forastero varieties of which it is estimated that 60 per cent of the population is Criollo. Approximately two-fifths of the Forastero types belong to the Angoleta and Cundeamor sub-varieties which produce fine cocoa as does Criollo.

The classification of the existing population resulted in the provisional determination of twenty-five types of which five were Criollo (one type being Procelaine Criollo) the remainder being divided up into the Angoleta, Cundeamor, Amelonado and Calabacillo sub-varieties of Forastero.

It is estimated that 1,300 cacao trees have survived and for practical purposes they have received no care or attention for thirty years. The lack of cultural care has adversely affected the growth of trees and the present pod yield. It was impossible to obtain any accurate quantitative estimate of yield but it appeared that certain trees, more particularly of the Angoleta and Cundeamor types, possessed possibilities as high yielders.

The principal pest was found to be the rat. A few minor diseases and insect pests were recorded. There is no evidence of " witches " broom or swollen-shoot diseases which threaten the cacao industries of the West Indies and West Africa. No pod diseases were observed as pods were seldom permitted to ripen on the tree without being gutted by rats; it is probable that under plantation conditions rat damage would be considerably reduced and controlled.

No definite statement can be made as to whether cacao cultivation on the suitable alluvial flats and moderate hill slopes of the wet zone of the Northern District (conservatively estimated at several thousand acres) would be economic at the present time without further detailed observations of growth rates, yields et cetera obtained from plots grown under approved methods of cultivation. The fact that many types of cacao have survived thirty years without any cultivation or attention, and certain types appear from field observation to promise high-yielding capacity, indicate that in selected areas the cultivation of certain types may be economical firstly as any production would be classified as fine cacao in the trade for which a premium has been paid in the past and secondly owing to the nearness of possible markets in the neighbouring Dominions.

A METHOD OF CURING PORK.

By
H. T. B. HALL, B.V.Sc.
Government Veterinary Officer.

In many parts of the islands where there are small isolated communities with no regular means of obtaining supplies of fresh meat from outside, the slaughter of animals is sometimes found to be wasteful in view of the fact that the meat so obtained will only keep fresh for a few days.

With the object of overcoming this difficulty to some extent, an experiment was carried out on the preservation of pork according to a method which is reported to be successful in Linconshire and Norfolk. The recipe used is as follows:—

> * Having killed the pig, scald and shave it and cut into large sections (a whole side may be used). Bone need not be removed. When cold, rub vigorously with salt, any kind will do—fine, coarse, or Fijian. Put into a tin, case or bin, and surround entirely with slaked lime. It can be taken out and used after one week, or after one year or even longer. There is *no* offensive smell. When you remove the bacon from the lime, wash all lime away and boil with spice for at least 1½ hours until a fork will pierce it easily. Take out of water, remove skin and dust nutmeg, or breadcrumbs, or crushed nuts. Allow to cool, eat cold like ham.
>
> The lime does not spoil the bacon in any way, and can be used again and again; apart from the little lime that clings to the meat, none is used up.

Accordingly, a side of pork was put down after being suitably cut into sections on 6th August last year. A large bin, made of kauri wood and jointed but not nailed at the corners was used as a container and the pieces were laid down with plenty of lime between each. Every care was taken to ensure cleanliness in handling and the directions as described above were carefully adhered to. Ribs and flanks were, however, deboned.

Three days later the sections were examined and it was found that the large joints, shoulder and hindquarter showed distinct evidence of putrefaction and were therefore discarded. The remaining pieces, ribs and flanks were still sound and were replaced in the lime for a further 23 days. The pieces on examination at this time appeared quite sound and quite dry on the surface but on incision a distinct unsavoury odour was noticed and a copious amount of clear viscid fluid exuded from the cut surface, more especially from the fat. This is due to osmosis caused by penetration of the salt. There had, however, been sound preservation of the meat for a distance in from all surfaces of ¼ inch, and this meat was firm and dry. Further in it was pale but not soft. There was no actual putrefaction to be found and the greenish tint usually associated with putrefaction was entirely missing. The unpleasant odour was very distinct, however, and none of the pieces could be said to be attractive to eat. On boiling a loin for an hour the odour disappeared and the meat was sound and edible and not unattractive in appearance. Twenty-two days later the meat was in the same state no further decomposition having taken place.

Twenty days later (the 68th day) the remaining pieces were examined and it was found that the unsavoury smell was still present if not so pronounced. The pieces had shrunk somewhat and the clear viscid fluid still exuded from the cut surface. The surface layer of sound meat had not increased. Due to the shrinkage the layer of moist pale meat in the centre was less. After boiling a piece of flank for an hour the smell again disappeared and the meat appeared edible.

Forty-eight days later (the 116th day) the process of preservation had advanced as far as the centre and the smell had entirely disappeared, the pieces had shrunk considerably and there was little fluid exudation. The pieces were firm but not as dry as "biltong" or "jerked beef." The general appearance was much more attractive than at any previous inspection.

It is concluded therefore that the method would be useful in isolated communities, provided the pieces were completely deboned, and cut into strips not wider than 1 inch to 1½ inches. Alternatively, larger pieces after deboning could be injected with lime in a manner similar to bacon but as this is a process requiring some apparatus and skill it is unlikely to be widely used. Simplicity must be the keynote of any system of preservation in outlying places. The most simple method used in countries of low humidity, sun drying, is not applicable here and consequently the method described could be quite useful provided the pieces are deboned and cut into strips before processing. The pieces should be examined frequently during the first week for signs of putrefaction and thereafter occasionally to see that they are properly covered with lime.

* *Pacific Islands Monthly*, March, 1943.

POSSIBILITIES FOR THE USE OF SHINGLE ROOFS IN FIJI.

By

J. L. D'ESPEISSIS, B.Sc., B.Sc. For., Dip. For.

Assistant Conservator of Forests.

ROOFING shingles may be either sawn or riven by hand. Special saw benches are manufactured for cutting shingles of the former type though they can also be cut on a small circular-saw bench with the help of a simple wooden attachment. Sawn shingles are nearly always tapered as to thickness: riven shingles are of constant thickness throughout. The purpose of the present note is to regard shingle-making as a village industry and to advocate the use of hand-riven shingles particularly in the construction of native-type houses.

Neither expensive equipment nor skilled labour is required in the manufacture of hand-riven shingles nor are any elaborate technical processes involved. Consequently, when conditions are such that it is difficult to import roofing materials from overseas, as at present, shingles are in a well-wooded country like Fiji an obvious solution of the roofing problem for they can be manufactured locally.

For this reason shingles were used quite extensively in Fiji by early European settlers. Shingle roofs were still in use in country districts of Fiji in the early 1900's and people who have lived in houses roofed with shingles maintain that this type of roof is water-proof, cool and, particularly in localities near the sea, equally as durable as corrugated iron. Moreover an improvement in durability might now be expected to be attainable by the use of modern preservatives.

Once again, to-day, due to wartime conditions, it is difficult to import suitable roofing materials and it would seem that the time is opportune for a revival of the shingle industry in Fiji. It may be argued that as these conditions are only temporary, there is no point in reviving an industry which is bound to die as soon as importations of other roofing materials become

normal again. Up to a point this is true, but, if the use of shingles could once be popularized in the field where it is particularly advocated, viz. as a substitute for the corrugated iron so beloved by Fijians in their villages, it should be possible to demonstrate several advantages over corrugated iron, which should ensure a continuation of the industry even in normal times.

A shingle roof possesses several advantages over thatch, notably greater durability (six to seven times the life may be expected), less harbourages for vermin and absence of dust. Further, shingles compare favourably with corrugated iron as they provide a more even temperature and this is usually acknowledged to be an advantage from the health point of view. Again, as an alternative type of durable roof for native-type houses, shingles would possess undeniable advantages from the aesthetic point of view.

It would appear that one of the things in life highly prized by the average Fijian is a durable roof and to provide himself with this he is prepared to devote the savings of years to the purchase of corrugated iron for this purpose which therefore represents a considerable outlay to him. The construction of a shingle roof, on the other hand, would require little or no expenditure on his part other than personal energy. In addition there is the desirable posibility that once a few men had acquired skill in the hand-splitting of shingles those possessing suitable timber might sell shingles to those less fortunate and so a useful village industry might be built up.

For the making of shingles it is desirable to use a sound light, straight-grained timber without knots, consequently the butts of trunks are chiefly used. In Europe, oak and larch are the species considered to be the most durable but owing to the abundance of Scots pine and spruce the latter species are more generally used. In the U.S.A., Weymouth pine, *Thuya*, juniper, *Taxodium*, *Sequoia* and Douglas fir are most commonly used, while in the western Himalayas deodar and other conifers are used. From this it would appear that it is from amongst the conifers that one usually finds species which possess the necessary characteristics of lightness and soundness and which are in addition straight-grained and fissile. Perhaps, therefore, it is not such a strange coincidence after all, that some of the species found to be most suitable in Fiji in the early days, and in the course of recent tests, should be members of this group, i.e. dakua salusalu (*Podocarpus vitiensis*), and dakua makadre (*Agathis vitiensis*).

Some interesting investigations have been made recently by the Forest Administration of Nigeria, into the local possibilities of "rough" shingle roofs. A test along similar lines to determine the suitability of various local timbers, was recently undertaken by the Fiji Forest Department and a rough shingle roof was constructed in Vanua Levu, similar to those tried in Nigeria.

The following species were tested:—

Dakua makadre (*Agathis vitiensis*),
Dakua salusalu (*Podocarpus vitiensis*),
Bauvudi (*Bassia* sp.) and
Kaudamu (*Myristica castanæfolia*).

From this test it was found that dakua salusalu is the most fissile and it was no doubt on account of this ease of splitting that this timber was used for shingles in the early days in this Colony.

The tools required are few and simple, i.e. a rive or splitting knife, a mall, an axe, a cross-cut saw, several wedges and an ordinary cane knife. The log to be used is cross-cut into 18 inch lengths and then split into suitable billets by means of ordinary wedges. Dakua salusalu will split readily on either the "quarter" or the "back", i.e. either radially or tangentially, which is a great help to efficient conversion. When the billets are of the correct width shingles may then be split off in $\frac{1}{2}$ inch thicknesses using the rive which is a broad wedge-shaped blade having on the top a vertical hitting bar. Towards the end of the test when the men employed were beginning to become proficient in the use of the rive it was found that the rate of splitting was approximately 100 per day per man—this includes subsequent trimming with a cane knife and stacking for seasoning—which at a wage of 3s. per day as paid in 1943, compares favourably with the Nigerian figure of 30s. per 1000.

A small open shed was constructed as part of the test using native materials throughout. The shingles were tied with vines of wame (*Freycinetia storkii*) to horizontal battens or poles of dogo (*Bruguiera gymnorhiza*) which were spaced 6 inches apart. One half of the shingles of each species was treated by the open-tank method with a preservative consisting of equal parts of creosote and diesoline, and one half was left untreated as a control. The size of shingle used was 18 inch long by 5 inch wide by $\frac{1}{2}$ inch thick but it was found while splitting that it was difficult in practice to keep to this width and thickness exactly. However, it was discovered when laying the roof that a variation between 4 and 5 inches in width and $\frac{1}{2}$ and $\frac{3}{4}$ inch in thickness is permissible.

When laid on a roof shingles are usually three deep and only one third of each shingle is exposed. Dimensions may vary from 16 to 24 inches long by 3 to 10 inches broad and from $\frac{1}{2}$ to $\frac{3}{4}$ inch thick. Using shingles 18 x 5 inches it was found that 100 shingles cover 16·8 square feet of roof area and the pitch of the test roof was 30° from the horizontal.

As a result of this experiment it appears doubtful if tied shingles would withstand a hurricane. It seems probable that they would have to be nailed and, if this is the case, it would undoubtedly be necessary to use sawn timber for the rafters and battens. This would increase the cost slightly but need not necessarily increase the monetary outlay greatly as, especially in Vanua Levu, pitsawing is practiced by the natives in many districts.

Obviously it is too early yet to be able to make any comparison of the relative durability of either the treated, or untreated, shingles of any of the species under test. The only comparison so far made is based on their splitting qualities and there therefore remains the possibility that one of the less durable and less economically important species, such as kauvula (*Endospermum macrophyllum*) or mako (*Trichospermum richii*) may prove with the aid of preservatives to be sufficiently durable to warrant its use. There still remains a considerable amount of work to be done and it is hoped that by continuing along these lines, sufficient information will be acquired to indicate a number of alternative species to dakua salusalu with the appropriate treatment to be used in each case.

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ENTOMOLOGICAL NOTES.

By

R. J. A. W. LEVER, B.Sc., D.I.C., A.I.C.T.A., F.L.S.,
Entomologist.

1. THRIPS INJURY TO LETTUCE.

In September 1942, Chinese gardeners in the Suva area reported a fairly serious infection on their lettuce leaves. Examinination showed this to be a leaf crinkling accompanied by reddening and was caused by a thrips kindly determined, through the courtesy of Mr E. C. Zimmerman of the Bernice P. Bishop Museum, Honolulu as *Thrips tabaci* Lindeman.

In Fiji most people are inclined to think that thrips are useful insects because of the introduced West Indian *Liothrips urichi* Karny keeping *Clidemia* under control. This is because Köster's curse is a weed but elsewhere thrips are commonly regarded as being injurious insects as is the subject of this note.

Although this thrips is almost a universal pest—being popularly called the onion thrips—and recorded from " the equator to Siberia " and " from sea level to 9,000 feet " (1), it does not appear to have been recorded before from Fiji. Further, it seems to be unrecorded from any other southern Pacific island being unrepresented in the extensive collections made by the Bishop Museum, Honolulu, in the Society Islands, Marquesas, Margareva (in the Tuamotus) and Guam and duly published in the well known bulletins or occasional papers of that excellent institution. Neither was *Thrips tabaci* described from Samoa or Tonga (2) nor from New Guinea or New Britain (3) and it is not till Queensland and South Australia are reached that this species appears in the southern Pacific. Another interesting point is that lettuce appears to be a new host plant as *Thrips tabaci* has been recorded from onion, carrot, tomato, cotton, beans and cabbage, etc., in Australia, many plants in the United States, including cauliflower and cabbage (4), but not lettuce.*

Damage caused by this insect in other countries are spotted wilt of tomatoes in California and Australia, pawpaw leaf spot and pineapple yellow spot in Hawaii and " blasting " or " silvering " of onions, cotton, carrots, squashes, peas and tobacco (1) in the United States. It also is a pest of onions, leak, tobacco and potato in Java but does not seem to be reported from Malaya.

As neither talc nor kaolin were procurable locally as insect carriers for dusting, finely pulverized soapstone was tried with derris but proved too coarse besides being laborious to prepare. Through the kindness of the Inspector of Mines supplies of very fine tailings from a gold mine, for control of *Plutella*, was used to carry the derris and dusting with this satisfied the growers. In the event, however, of further outbreaks, nicotine sulphate or tartar emetic and sugar sprays will be tried as dusting does not easily reach the innermost heart of lettuces.

Nymphs were more abundant in January 1943 than in the previous September. It was not possible to completely follow Evan's turpentine method (5) of separating the insects from the leaves, no circular zinc plate being available. However, ordinary perforated zinc sheeting sufficed without a lamp, specimens being received direct into 70 per cent alcohol in a petri dish placed under the gauze.

* Since the above was written a paper has been seen by a Japanese worker listing *T. tabaci* from lettuce in Hawaii (6) where, however, no leaf-crinkling or other abnormality was caused.

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(4) Metcalf, C. L. and Flint, W. P. 1939—"Destructive and Useful Insects", New York and London.
(5) Evans, J. W. 1933—*Bull. Entom. Resch.* Vol. 24, Part 3, Sept.
(6) Sakimura, K. 1937. Proc. Hawaiian. Ent. Soc. Vol. 9, No. 3, Sept., p. 419.

2. MAGGOTS IN IMPORTED BOOT POLISH.

Early in July 1943 the Medical Officer of Health, Lautoka, forwarded a tin of New Zealand black boot polish returned to the vendor by a purchaser who complained that it was full of maggots. Examination in Suva confirmed this, most of the grubs being in the superficial portion; the flies which subsequently emerged were determined by the Imperial Institute of Entomology as *Megaselia scalaris* Lw. This is a common Phorid previously reared from diseased pineapple suckers (1922), dead larvæ of *Agrotis*,—not *Heliothis armigera* (Hbn.) (1)—dead pupal *Levuana iridescens* B.B. (1925) and the rotten central leaves of a coconut palm (1939)—in other words it is associated with decomposed animal and plant remains. Last year specimens were taken from windows of a plane which had arrived from the New Hebrides.

The polish, made by an Auckland firm, was analysed by the Government Chemist who showed it to be normal consisting mainly of wax, stearine and lamp black. Presumably the eggs were laid by the flies either in the lard in the abattoir or in the factory.

(1) Lever, R. J. A. W. 1940—*Agric. Journal*, Fiji, Vol. 11, No. 4, December. P. 100.

3. NEW HOST RECORDS FOR FRUIT FLIES.

In December 1943, ripe growing bread fruit (*Artocarpus incisa* Thunb.) and jak fruit (*A. heterophyllus* Lamb.) were found infested with Trypetid maggots which were reared into adults of *Chaetodacus* (*Strumeta*) *passiflorae* Frogg. and *Notodacus xanthodes* Broun, both fruits being new records for the Colony. A point of some interest was that though ripe mangoes were available near the bread fruit trees no larvae were found in them; mango is known (1) as a favourite fruit. This opportunity is taken of correcting Simmond's employment (1) of rose apple for *Eugenia malaccensis* L. (kavika) as this name really refers to the related smaller species *E. jambos*, the popular name of *malaccensis* being the Malay, Malacca, African or mountain apple, with a polished darker pink fruit. Incidentally, two fruits given in his list as being endemic to Fiji are actually found in Malaysia and other Pacific islands, viz. *Spondias* (*Pometia*) *pinnata* Forst. (dawa) and *Inocarpus edulis* Forst. (ivi) the Polynesian or Tahitian chestnut.

During January 1944 the life cycle of *N. xanthodes* took 19 to 20 days (egg 2 to 3, larva 5–6 and pupa 11 to 12 days) which agrees well with Simmonds' "egg to pupal period" of 6 to 9 days and pupal period of eleven to twelve days in "mild summer weather"(1). Fruits used in 1944 were grenadilla, guava and breadfruit.

Despite provision of fresh cut pawpaw (*Carica papaya* L.) oviposition only but no development was obtained in this fruit, though Broun (2) records *Notodacus* from "mummy apple" (i.e. pawpaw) fruits examined on the Auckland wharf from Rarotonga and Tonga and on pineapples from Fiji. This was confirmed four years later (3), pineapples and oranges from Fiji and Rarotonga being affected.

Larval parasites in January 1944 were *Biosteres tryoni* Cam. (previously recorded from *Chaetodacus passiflorae*), another Braconid and *Spalangia* sp. which will all be dealt with in a later note.

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4. THE SPECIES OF *BRONTISPA* BEETLES IN MELANESIA.

In a paper (1) published in 1938 but only recently seen, Maulik revises the genus *Brontispa*, a small Hispid beetle all of whose stages are found between adjacent unexpanded leaflets of various species of palms. He refers to specimens sent by the writer from the Solomon Islands as coming from "unopened buds" but this is incorrect; the insect feeds inter- rather than intra-pinnally on unopened leaflets and so is not a true leaf-miner as in the better known *Promecotheca* (2).

In sinking what were separate species into mere colour varieties of *B. longissima* Gestro, Maulik's systematics are confirmed by field observations throughout the wide range of this coconut pest but it is worth pointing out a discrepancy in size. Two entomologists in New Guinea, presumably with abundant live material, state var. *simmondsi* Maulik is "slightly longer" (3) than var. *froggatti* Sharp whereas in the original description (4), *simmondsi* is said to be smaller and this Maulik reaffirms in his recent paper (1) where it is said to measure 9.00 mm. in length compared with 9.50 mm. for *froggatti*. A reference which needs correction is one by Awibo (5) who uses the name *B. froggatti* Sharp var. *selebensis* (Gestro) Maulik for the Celebes species which should be *longissima* Gestro *selebensis* Gestro.

Maulik gives the food plant as the coconut only but should also have mentioned another common economic palm, viz. betel (*Areca catechu* L.) recorded by the writer in 1936 (6) from Malaita. More recently it has been taken in New Guinea from betel and sago as well as introduced palms (7)

Lastly, the distribution listed in detail by Maulik (1) omits New Caledonia though this island was recorded by Jacques (8) as long ago as 1930 and subsequently, the beetle being a serious pest.

It is important that the nomenclature of this beetle should be finalized as in the Solomon Islands alone it cost one firm £7,000 per year in control. The correct name therefore is *B. longissima* Gestro, the variety *froggatti* Sharp ranging from New Caledonia and the New Hebrides through the Solomons and Bismarcks to New Guinea and var. *simmondsi* Maulik in Manus (Admiralty), Vitu or Witu and near Madang on the northern coast of New Guinea.

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5. TERRESTRIAL AND AQUATIC CRICKETS.

CRICKETS are well known to everyone from their domestic association with our hearths and the chirping noise they make by rubbing their forewings together. What is less well known is that on the longest joint (tibia) of the front leg there is a so-called ear or auditory organ which " hears " the rasping noise made by the wings of another individual.

The commonest cricket in Fiji is *Gryllus oceanicus* Le. Guill., also found in Tonga and Samoa (1), a squat dark brown insect, the female having the typical bifid sword-like ovipositor. This is the usual cricket attracted to lights in houses and does some damage to young sugar cane (2).

Another domestic species is *Metioche insularis* (Sauss.) which is a slenderer insect of a buff colour with the habit of cutting pieces in silk which are then rolled up something in the manner of the leaf-cutting bees, *Megachile* spp.

On wet surfaces of boulders in rivers and on rocks splashed by water-falls one may find the very active *Hydropeticus vitiensis* Miall. et Gilson, a delicately built insect with very long thread-like antennae and a feathery arrangement of spines on the hind tibiae. It is confined to Fiji.

Two much smaller crickets are *Trigonidium flavipes* Sauss. and *Cyrtoxipha fulva* (Sauss). usually found in herbage

The last cricket to be described is of most interest: it is *Cardiodactylus novae-guineae* (de Haan.) which, as its specific name shows, occurs in New Guinea, as well as in Tonga and Samoa (1). Simmonds (3) records it only from the Solomons where the present writer took it on coconuts from the Shortlands in the west to Malaita in the east (4), recording it as a pest on young palms on St. George's Island, Isabel. It is fairly scarce in Fiji and was not taken by the University of Iowa Expedition in 1927 (5): the writer, however, met with it in the dry leaves which collect in the leaf-bases of the large screw pine *Pandanus tectorius* (Sol.) Rumph. It has not been taken on coconuts in Fiji so far as is known.

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6. NEW AND LESS COMMON MOSQUITOES OF VITI LEVU.

LARVAE of what was recognized to be a new species of mosquito for Fiji were found along the edges of the River Nadi last year by the assistants of the Mosquito Inspector, Mr. Amos. After a certain amount of uncertainty it was eventually identified as the Austro-Malayan *Aëdomyia venustipes* Skuse whose larvae elsewhere obtain their air by piercing stems of water lettuce, *Pistia* (1). Early in December the writer made a thorough search along this river but took only one of these larvae after dipping for two hours with a couple of assistants. The larva is interesting on account of the peculiar bull's horn like development of the antennae. It was associated with both *C. albinervis* and *C. annulirostris* and its scarcity would tend to make one think these two were the only species represented along the river margin. No higher plants were pierced for air—green algae only being present where these larvae were taken.

Previously this mosquito was recorded from the Orient and Australia (Northern Territory, Queensland and New South Wales), having been described in 1889 from specimens taken at Elizabeth Bay, near Sydney.

It was originally placed in the genus *Aëdes* but *Aëdomyia* was created in 1901 and some confusion arose in 1909 through the same mosquito being described by Knab as *catasticta*.

The long-legged mosquito *Uranotaenia colocasiae* Edw. is said by Paine (2) apparently not to occur at all in the Suva area and this is probably still correct if one refers to Suva proper but is fairly common in dalo leaf axils at Lami, about three miles radius from the General Post Office.

In this same area, as well as inland from Prince's Road towards Kalabo and at Nasinu, the squat, hairy larvae of *Tripteroides purpurata* Edw. are commonly found in cut stumps of growing bamboo; Paine's data (2) show tree holes to be the favoured sites and he does not record it from Viti Levu but only from the smaller islands of Taveuni, Vanuabalavu, Gau and Moturiki where he chiefly worked. Besides the narrow band of blue scales behind the head this mosquito has pearly ocelli on the abdomen.

The sedge from whose roots larval *Mansonia brevicellulus* Theo. were taken last August at Nadi (3) is *Eleocharis* sp. near *articulata* Steud. Continued dipping in this swamp last December failed to secure anything but *C. annulirostris* Skuse. The absence of abdominal ocelli in *Mansonia* serve to separate it from *Tripteroides*, an easier character than the blue scales.

At Lami in 1928 Paine took in a fresh water ditch larvae of a new mosquito, which appears to be restricted to Fiji. It was described by Edwards (4) as *Culex albinervis* as it has a bare spot on the wings caused by an absence of pigment on the veins or " nerves " in the centre of the wing.

Paine subsequently took it on Taveuni (2) under similar conditions, viz. at stream edges associated with filamentous green algae; at 1,500 feet on Viti Levu and again in a dalo (*Colocasia*) swamp on the small island of Naigani lying between the Tailevu coast and Makogai.

In November 1943 the writer took larvae of this mosquito west of the Tamavua River not far from where it was first recorded sixteen years previously. The sites were a swampy field and a small pond with thick patches of algal scum; four visits to this latter area has revealed this species only which is often green in colour due to the algae which apparently form the bulk of its food. It has also been taken along the Suva Point Road.

As the larvae of both *C. albinervis* and *C. annulirostris* have long siphons it is perhaps excusable to confuse these species at a first glance but the length expressed as a ratio of the breadth of the siphon is respectively 8:1 and 5:1 which serves to avoid confusion. The tufts are also more pronounced in *C. annulirostris*.

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7. THE COCONUT STICK-INSECT.

In Fiji one species of stick-insect, *Græffea crouani* (Le Guill.), is a serious coconut pest making characteristic V- or U-shaped gaps on the edge of coconut leaflets giving the appearance of cuts made by scissors. Severe damage may result when only the midribs are left and control by lighting smoky fires beneath the palms on calm days has often to be followed.

The female measures up to $4\frac{1}{4}$ inches in length and has very short hind wings while the male rarely exceeds $2\frac{3}{4}$ inches but has fairly well-developed hind wings of a rosy pink colour. The front wings are mere vestiges in both sexes. The flat seed-shaped egg measures 7 mm. in length and takes from ten to sixteen weeks to hatch into a very feeble nymph.

Dr. Chopard of Paris clearly showed (1) that *crouani* Le Guillou 1841 had priority over *coccophaga* Holdhaus 1908 though this in turn was antedated by *coccophagus* Newport 1844 as shown by Bruer (2). In 1930 the writer used *crouani* (3) but eight years later Simmonds (4) preferred *cocophaga* Newp. which is not recognized.

Although recorded as a coconut pest as long ago as 1908 no published reference to any other plant attacked has been located. In April 1939 this insect was found eating leaves of the large screw pine *Pandanus tectorius* (Sol). Rumph., the reed *Miscanthus japonicus* Anderss., besides young coconut palms, in the Lovoni valley, Ovalau.

It is interesting that these insects are normally most serious pests in the smaller islands as shewn by Jepson (5) who listed Cicia and Mango in Lau besides Ovalau. This holds good to-day with the addition of Rabi though in the large coconut plantations of Savu Savu, Natewa and Wainunu Bays in Vanua Levu they still are pests, as in 1911. Lighting fires on a still day was recommended recently and a report was received that it was successful in February, 1944, the weeds and grass being cut back to a distance of a yard from the bole and fired when dry.

This insect also occurs in Eastern (American) and Western (New Zealand) Samoa.

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CHEMICAL NOTES.

SUMMARY OF RECENT INVESTIGATIONS CARRIED OUT IN THE CHEMICAL LABORATORY.

By
W. J. BLACKIE, F.I.C., M.Sc., F.N.Z.I.C.,
Senior Chemist, Fiji.

1. *Derris.*—The dried roots of several species of derris have become important commercially as a source of potent insecticides non-toxic to human and domestic animals. The root is valued in England according to its content of resin extractable by ether and in the United States by the content of active principle—a white crystalline material called rotenone. In 1932 Blackie (1) reported the presence of rotenone in the local fish "poisoning" plant *derris uliginosa* subsequently confirmed by Jones (2).

Since that period attempts were made to establish varieties of *Derris elliptica* from high yielding rotenone strains grown in Malaya. The plants grew well on our local soils but as recorded by Blackie (3) the ether extract and rotenone contents were disappointingly low. It was assumed therefore that either our soils were unsuitable in respect of yield of active principle or that strains which yielded high rotenone under Malayan conditions reverted when established on our soils.

Recently a new strain was secured from the Amani Research Station in Tanganyika and the few plants which survived the journey were established on the Sigatoka Experiment Station.

Owing to the intervention of the war it was not possible to continue with the studies as originally planned and the plants were harvested after three years of growth instead of the usual period of 18 months to two years. It has been established that the percentage of rotenone is highest after 18

months to two years growth. Nevertheless, the contents of rotenone and ether extract in the Amani strain were excellent and it now appears certain that commercial material is capable of growth in Fiji. The results obtained on moisture free basis are recorded as follows:—

Amani Derris.	Ether Extract. Per cent.	Rotenone. Per cent.
Sample 1	17·9	6·0
Sample 2	23·4	8·9

2. *Shark Oil.*—Considerable quantities of cod liver oil and other vitamin A and D containing oils are consumed annually in Fiji. Shark oil is an excellent source of vitamin A and, if well prepared, is suitable for both humans and stock.

A sample of shark liver-oil from the livers of one male and one female was prepared locally. The species of shark is known locally as the " School " shark; the scientific name is not known with certainty.

A chemical examination of the oil gave the following values:—

Iodine value (Hanus) = 96·3
Saponification value . = 180·3
Vitamin A .. .. = 15·0 Carr Price Blue Units.

Two samples of imported cod liver oils submitted by the Government Pharmacist for comparison had the following vitamin A values:—

Sample No. 1.—Vitamin A content = 9·3 Carr Price Blue Units.
Sample No. 2.—Vitamin A content = 10·6 ,,

It is therefore apparent that the local shark liver oil had a greater Vitamin A content than the imported oils.

3. *Local Chaulmoogra Oil.*—The fixed oil from the fruits of several species of *Hydnocarpus* is used with marked success in the treatment of leprosy. This genus is not native to Fiji, and therefore, in order to provide oil from local sources the Department of Agriculture imported some years ago, planting material of *Hydnocarpus wightiana* and *Hydnocarpus anthelmintica*. Some difficulty was encountered in establishment on certain soil types but seedlings planted on the island of Makogai grew well and produced good crops.

During the absence of the Government Chemist from the Colony samples of oil prepared at Makogai were submitted in 1938 to the Imperial Institute for examination and the report indicated that the samples agreed in every particular except the rotation with the requirements of the British Pharmacopoeia.

A sample of oil submitted by Dr. Austin of Makogai, from the 1943 crop has been examined in the Government Chemical Laboratory with the following results:—

	Local oil.	British Pharmaceut. requirements.
Iodine value (Hanus) ..	= 91·8	97 to 103
Saponication value . ..	= 202·8	198 to 204
Refraction index n_d^{40} ..	= 1·4748	1.472 to 1·476
Rotation $(a)^{d}25$	= +57·7	+ 53

It is thus seen that the oil now conforms with the main requirements of the British Pharmacopoeia and although the iodine value is a little lower than usual it is well within the range of recorded values and the oil is satisfactory in treatment.

4. *Datura sp.* (probably *D. metel*).—A sample of leaves of a *Datura* species probably *D. metel* was submitted by Mr. B. E. V. Parham of this Department for determination of alkaloid content. The sample contained 0·28 per cent of mydriatic alkaloids chiefly hyoscine with a little hyoscyamine. The content of mydriatic alkaloids in the leaves of *D. metel* varies from about 0·24 per cent to 0·55 per cent and therefore the content for the sample submitted indicates a potential source of a valuable drug.

5. *A Reputed Quinine Bark.*—A sample of the bark of " dabi " listed by Mr. B. E. V. Parham (4) as either *Carapa moluccensis* or *C. obovata* was submitted for examination by Mr. H. Sabben, the Mechanical Engineer. It was stated that the bark had a bitter taste and had some medicinal use, although neither B. E. V. Parham (4) nor Mrs. Richenda Parham (5) have made reference to its medicinal or poisonous properties. Pammel in his catalogue of the Poison Plants of the World lists *C. moluccensis* on the authority of Greshoff but no information is given as to the nature of the poison nor physiological reactions.

A study of the sample submitted showed the absence of alkaloids and glucosides and the main constituents appeared to be tannins which might account for the bitter taste experienced by some observers but not noticed with the present sample.

Fresh samples of young bark have been secured for further investigations.

6. *Soils of Sigatoka Experiment Station.*—A soils survey was made of the Sigatoka Experiment Station in 1939 and several soil samples from five profiles were secured for laboratory examination. Determination of pH, total exchangeable bases, exchangeable calcium, sodium and potasium, lime requirement; available P2O5 and the mechanical analysis have now been completed and the results obtained will be discussed in detail in a further communication to the Journal.

From field data three main soil types are recognized on the station and in general, chemical and physical determination present a happy state of affairs in respect of the agricultural worth of the main Sigatoka type which ranks with the best on Viti Levu.

7. *Phosphate Status of some South Pacific Soils.*—Approximately 200 soil samples from the islands of Viti Levu, Vanua Levu, Taveuni, Lau, Koro, Rotuma, Tonga and Canton have been examined for their content of available phosphate by recognized standard technique.

The data secured will be discussed in greater detail in a further contribution to this Journal but in general it can be stated that the position is not good and in certain areas the P_2O_5 content is so low as to constitute a definite limiting factor in productivity. In general, recognized good soils in Fiji have high P_2O_5 available for plant utilization whereas poor soils have low available P_2O_5. The close connexion between yield of sugar cane and P_2O_5 status of the soils is clearly shown in the case of the Rewa cane sugar soils which are discussed in detail elsewhere in this number of the Journal.

8. *Pilfering of Petrol.*—From time to time samples of petrol are submitted to the laboratory for identification and comparison. Before the war a " straight run " uncoloured gasoline was available to the public but within recent years new grades of " cracked " petrol have been available; moreover aviation petrol of high octane rating is used for army purposes.

The present petrol available to civilians is identical with army transport petrol and it is therefore impossible to distinguish between army and civilian supplies in cases of alleged pilfering. The Senior Chemist has made certain

recommendations in respect of the problem which, if adopted, will limit markedly pilfering from supplies.

Recently a certain amount of aviation petrol has been going astray and samples of mixtures of civilian and aviation petrol have been submitted for examination. This problem has been investigated by (*a*) comparison of physical properties of the sample with the known physical properties of the components and (*b*) a study of the dyes in the mixture. The low tinctorial power of the dye associated with aviation petrol makes it difficult to distinguish the dye components by means of the spectroscopic equipment at present available locally, particularly with small samples; however, a study of the new process of chromatographic absorption has led to a method which permits a clean separation of the dyes for spectrographic and chemical study.

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COPRA NOTES.

1. COSTS OF COPRA PRODUCTION.

By
H. W. JACK, O.B.E., B.A., D.Sc.
Director of Agriculture.

DURING December last year an enquiry was made through the members of the Copra Advisory Committee into the costs of production of copra in the main producing areas and it is considered that the results obtained will be of general interest.

Accurate figures were not easy to collect since detailed accounts are maintained on but few plantations but the majority of the members of the Committee agreed that the following figures fairly represented the costs of production per ton "on the beach" in December 1943:—

Collecting and cutting	£1	18	6
Transport	0	13	0
Drying	0	7	6
Bags and twine	0	9	0
Bagging and shipping	0	2	0
Sirdars, cooks, milkman, etc.	0	17	6
Supervision	1	0	0
Weeding	0	3	0
Maintenance: fences, roads, tools, etc. ..	0	10	0
Fire insurance of buildings and copra ..	0	2	6
Land rent	0	10	0
Depreciation of buildings, driers, etc. . .	0	9	0
Depreciation of palms	0	10	0
General expenses..	0	2	0
Total ..	£7	14	0

The above figures indicate the approximate actual disbursements at the present time when labour is short; with adequate labour available weeding would doubtless be in the region of 9s. per ton which with an increase in the cost of bags (used four times) of about 1s. per ton would thus, bring the total up to £8 1s. per ton.

In parts of Vanua Levu the above figure is considered low especially in regard to collecting and cutting-out the copra as tasks are materially lower than in Taveuni and other areas, and the maintenance of roads, fences, bridges, tools, etc., which of course, must vary materially with varying local conditions.

The above costs do not include interest on capital which might reasonably be placed at £1 5s. per ton making the cost of production " on the beach " £9 6s. per ton.

Copra-growing conditions are so very variable in Fiji that the above figures can only be regarded as indicative of a reasonable approximation and, of course, the Group is subject to occasional damaging hurricanes for which no allowance is made. Furthermore, during the past few years of labour shortage, weeding and general maintenance on estates have fallen much into arrears while planting has been entirely neglected so that as soon as labour again becomes available, these items will require considerable and costly attention if the estates are to be adequately maintained.

It is hoped that labour conditions will soon improve so that production may be materially increased for the general benefit of the Colony.

Comments on the above figures will be welcomed from practical planters.

2. COPRA NOTES.

COPRA grading has continued through 1943 the net result being that 26 per cent of all copra in Fiji (excluding Rotuma) was graded as plantation grade and 74 per cent as fair merchantable sundried grade. Unfortunately, the actual tonnage of copra graded and exported in 1943 cannot for security reasons be published at present.

Of the total production in the Colony, Lau supplied 14 per cent, Taveuni 19 per cent, Lomaiviti 7 per cent, Vanua Levu 46 per cent, Viti Levu, Kadavu and the Yasawas 7 per cent and Rotuma 7 per cent. —C.H.

SUPPLY OF FRESH FRUIT AND VEGETABLES TO THE MILITARY FORCES IN 1943.

By
C. HARVEY, B.Sc., A.I.C.T.A.,
Senior Agricultural Officer.

THE following is a tabulated statement of deliveries of fresh produce to the military forces during 1943:—

	Western Area.	Eastern Area.	Total.	Approximate Value.
	lb	lb	lb	
Fruit	3,058,392	2,619,946	5,678,338	£35,000
Vegetables	2,695,643	2,640,785	5,336,428	40,000
Root vegetables ..	1,359,139	3,150,691	4,509,830	15,000
Total ..	7,113,174	8,411,422	15,524,596	£90,000

The above represents daily deliveries of nearly 18 tons throughout the year.

Approximately 75 per cent of the total deliveries of fruit and 85 per cent of the roots were grown in the Southern Agricultural Division (corresponding to the Eastern (Supply) Area as shown in the above table) while vegetable production was almost exactly equal in the Southern and Western Divisions. Thus, large quantities of fruit and roots had to be diverted from the Southern Division to the Western area collecting centres.

Fijians produced approximately 85 per cent of the fruit, and Chinese and Indians about 12 per cent; the balance of three per cent came from the Colonial Sugar Refining Company and Wainiloka (Ovalau) pineapple estates. Chinese contractors handled approximately half of the Fijian grown fruit. Indians supplied 45 per cent of the vegetables, Chinese 35 per cent and Fijians 20 per cent. Fijians produced 90 per cent of the root crops, the balance being grown by Indian farmers.

Orders fell off considerably towards the close of the year. The Ba collecting depot was closed in December and the Sigatoka depot in January 1944 except for fruit. In the Western area it is anticipated that the Nadi district can supply the full requirement of vegetables.

Guarantees that have been taken up, amount to £94 0s. 11d. to the 31st December. It appears likely that the total will not exceed £150 at the expiry of the three months period of notice of cancellation. Fortunately the contraction in demand coincided with the season when vegetable production declines, but apart from this Agricultural Officers were able to give early early notices of cancellation in anticipation of reduced orders.

Where produce has been delivered to depots it has been almost impossible to find alternative outlets for it. Diversion to hotels, etc., has been attempted in the Western Division and the Agricultural Officer West is endeavouring to arrange for a municipal market in Lautoka, where good vegetables are in demand, so as to take advantage of growers' interest in vegetables. This interest will soon wane unless local marketing facilities can be created or improved.

The dalo situation is slowly improving though supplies are still very short. Discussions have taken place with the Adviser on Native Affairs and District Commissioners and a special effort is being made to see that Provincial planting programmes in respect of food plantings are carried out.

EXPORT OF FRUIT AND VEGETABLES TO NEW ZEALAND.

By

C. HARVEY, B.Sc. A.I.C.T.A.,

Senior Agricultural Officer.

BEFORE the war spread to the Pacific there was a useful export of vegetables and fruits (apart from bananas and citrus) to New Zealand. In 1939 these minor exports included fresh pineapples, pumpkins, watermelons, papaya, yams, kumalas, dalo, green ginger, cucumbers, tomatoes, mangos and fresh coconuts, while in other seasons there have also been small shipments of grenadillas and avocado pears.

During the past two years small holders, particularly, have profited by the greatly increased local demand and have taken up the growing of vegetables. With a view to encouraging some of the growers to maintain their vegetable production, enquiries have been made in New Zealand as to likely demand for Fiji produce during the forthcoming season and information supplied by one of the leading agencies in Auckland is given below. Because of transport difficulties and uncertainties of overseas shipping it is unfortunately the case that producers in islands other than Viti Levu will be prevented from participation in this trade, and many of the items are normally grown for export only within easy reach of Suva.

Any persons interested should write to the Director of Agriculture, Suva, for further information.

Pumpkins.—There is little demand for Fiji pumpkins as the quality compares unfavourably with New Zealand grown pumpkins, which are normally held over through the year.

Watermelons.—Excellent prices have been obtained for Fiji melons during the present season (1943–44). Shipments later than mid-January may be unprofitable as competition from New Zealand grown fruit has to be met; in any case Fiji melons are going off by this time. (Note: Fiji melons netted growers as much as 8s. each during the past season, after payment of freight and commission charges).

Grenadillas.—There is a limited demand for these.

Kumalas.—A considerable quantity of these could be handled, subject to the issue of import licences in New Zealand. £10 per ton f.o.b. Suva is mentioned as the probable price.

Mangos.—There is a limited demand, and the quality is said to compare unfavourably with fruit from the Cook Islands.

Avocado Pears —There is a limited demand and shipments of 50 to 100 cases at a time could be handled.

Yams.—There is a limited demand and 20 to 30 sacks per shipment could be handled.

Green Ginger.—The firm concerned could handle 20 to 50 cases a month, apart from connections already established with other firms.

Tomatoes.—During the period July to October some thousands of cases could be handled, subject to import licences being obtained.

Cucumbers.—These could be handled in the ratio of one case of cucumbers to every five cases of tomatoes shipped.

Papaya.—Regular consignments reach New Zealand from Western Samoa but demand is very limited and the difficulty is to get the fruit picked at the right stage; if shipped green the fruit develops no flavour, if more than half ripe then losses may be heavy.

Pineapples.—Importation of this fruit (fresh) into New Zealand can only be made through the Internal Marketing Division. Several consignments —all that was offering—were accepted during the past season, a fixed price of 12s. a case f.o.b. Suva being paid, a case continuing from 24 to 36 fruits according to size.

ROCK MELONS AT THE GENERAL EXPERIMENTAL STATION.

By
C. R. VASEY,
Agricultural Assistant.

On the 20th August 1943 at the General Experimental Station, Sigatoka, 1·3 acres was sown to "Hales Best" rock melon, mildew-resistant No. 45 strain. The seed was sown in hills spaced eight feet apart on the square and a six ounce dressing of blood and bone manure was applied to each hill at the time of planting.

Germination was slow owing to the lack of rain and when the plants came through they had to contend with a heavy growth of nut grass. Supplies were made in the second week of September; the total quantity of seed sown was three ounces. Throughout the growing period the block was regularly cultivated until the growth of the vines made further cultivation impossible.

Picking commenced on the 18th November and continued at two day intervals until the 6th December when the crop matured so fast that it was necessary to pick daily for one week. The final picking was made on the 15th December. Apart from a few melons consumed on the station the entire crop of sound fruit was sold. The seed was extracted from mature fruits and retained for sowing.

The total weight of melons sold was 19,554 pounds and at twopence a pound realised £162 19s. A conservative estimate of wastage was 15 per cent and with this included brings the total yield to 22,487 lb—a very satisfactory figure.

The land planted was alluvial river flat and had been in continuous cultivation for fifteen years. The rainfall during the growing period was 20·27 inches, some 17 inches of this falling in October and November. The efficiency of this mildew-resistant strain was very apparent. Mildew was non-existant while a crop of water melons two chains away was practically wiped out.

After the fruit has set, weed growth is no disadvantage. In this crop the fruit was shaded by the high nut grass.

Cultivators with good land such as river flats near any of the large centres should find rock melons very profitable. Even when the demand for military supplies diminishes there should be a good civilian market. The soft nature of the fruit precludes it being grown long distances from the market unless despatched in a green condition with consequent loss in flavour.

Seed per acre	2·307 oz.
Manure per acre	255 lb blood and bone.
Yield per acre	17,575 lb.
Value per acre	£146 9s. 2d.
Value of seed recovered, 15½ lb at 14s. per lb	£10 17.

Cost of production (Area, 1·3 acres):—

Ploughing at 30s. per acre	£1	19	0
Harrowing (2) at 7s. 6d. per acre	0	19	6
Planting, 3½ units at 3s. 6d. per unit ..	0	12	3
Supplying, 1 unit at 3s. 6d. per day ..	0	3	6
Cultivating—			
Six days at 1s. 6d. per day (stock and implement)	0	9	0
Six units at 3s. 6d. per day	1	1	0
Weeding, 9 units at 3s. 6d. per day ..	1	11	6
Harvesting, 20 units at 3s. 6d. per day ..	3	10	0
Seed, 3 oz. at 10½d. per ounce	0	2	7½
Manure, 3 cwt. at £1 per cwt.	3	0	0
Total ..	£13	8	4½

Cost per acre £10 6s. 8d.

A BLOOD-SUCKING MITE OF POULTRY.

By
R. N. SANDERS, B.V.Sc.,
Veterinary Officer.

THE red mite (*Dermanyssus gallinæ*) was found recently at Nadi for the first time in Fiji; the tropical fowl mite (*Liponyssus bursa*) was reported in Suva some two years ago. As the red mite infestation was a very heavy one and as this mite can cause heavy losses, a few notes for the guidance of poultry owners is perhaps timely.

Both of these mites are blood-suckers and if in sufficient numbers can be very injurious to young birds by making them anæmic. If the bird is not actually killed by the anæmia, its resistance is lowered for other diseases. Moreover, the red mite is a known vector of fowl tick fever, which disease can cause a heavy mortality in a flock. Broody hens will leave the nest if they are irritated by these mites.

Both types are very small and cannot be differentiated by the naked eye. They have a rough resemblance to spiders much smaller than a pin head. When engorged they are red in colour, and at other times a whitish grey.

The tropical fowl mite feeds both day and night and is found on the bird at any time, particularly about the vent. On the other hand, the red mite is a night-feeder. After it has engorged on blood it leaves the host and hides in cracks, etc., in the perch during the day. Consequently, very few, if any, red mites will be found on the birds during the day although the infestation is a heavy one. The red mite is mostly found in crevices and joints on the roost. Where round bush timber is used as perches a favoured hiding place is under the dried bark.

The life cycle of both mites is completed in about seven days, so that, given favourable conditions, a few mites can soon be responsible for a very heavy infestation.

The red mite can be controlled by burning all litter and nesting material and painting all perches and nests with creosote. Probably the best method is to paint all perches in the late afternoon with nicotine sulphate. This will kill all mites it contacts on the perch, and the body heat of the roosting birds will cause the nicotine sulphate to give off fumes which will pass up through the feathers killing mites and lice. Care should be taken that the house has some ventilation, as the fumes, if in sufficient concentration, may kill the birds. However, too much ventilation causes too great a dispersion of the fumes to do any good. Best results are obtained when the nicotine sulphate is applied for two nights and again after ten days.

Control of the tropical fowl mite is the same as the above but to get the best results the birds must be dipped. A good dip consists of one ounce of sodium fluoride to each gallon of water. Place each bird in the dip with wings outspread making certain that the fluid penetrates to the skin. Do not dip birds on cold or wet days. Sodium fluoride may be applied as a dusting powder but is not as effective as the dip.

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FOOD OF THE GIANT TOAD.

THE last article in this periodical on the local diet of the introduced toad (*Bufo marinus* L.)—in the issue for March 1939, Vol 10, No. 1—showed that the various insects, slugs and other creatures, which were eaten, were all harmful to man and so the toad was beneficial. On two occasions separated by a year it was found from post-mortem examinations that not all the insects selected as food were pests, both ladybirds and bees being eaten. The details are as follows:—

1. Male toad taken at Nasese, 14th January, 1943:—
   One *Polistes hebraeus* F. (hornet), 3 caterpillars, and 1 *Coccinella transversalis* F. (ladybird).
2. A second male, captured at the same place on the same day, revealed:—
   Five caterpillars and 1 undetermined Coccinellid.
3. Immature female, Suva, 31st January, 1944, sent by an apiarist:—
   A large mass of heads and wings of several hundred bees and two nymphal cockroaches. These were consumed near a beehive.

The writer is informed that a special barrier has to be erected in order to keep toads away from the alighting board of bee hives which clearly suffer badly from attacks by toads.

This opportunity is taken of giving two other unpublished post-mortem examinations:—

4. Female, Rabi Island, near edge of bay at landing, 5th October, 1941:—
   One crab, 1 hermit crab in Gastropod shell and 1 large spider.
5. Another female from the same locality but in the garden of the manager's bungalow gave:—1 earwig, 2 crickets, 1 beetle and 1 snail (*Subulina octona* Breug.).

SUVA RAINFALL FOR 1943.

January	10·36	May	6·23	September ..	3·33
February	7·76	June	1·28	October ..	8·56
March	6·56	July	2·44	November ..	12·78
April	21.53	August ..	2·05	December ..	5·56

Total 88·44 inches.

It will be noticed that the rainfall for the months from June to August, inclusive, totalled only 5·77 inches which, compared with 19·88 inches—the average total for the last 57 years—is just over a quarter. The 1943 drought taught many gardeners how tolerant seedlings can be of continued applications of soapy bath water, the only liquid available for watering purposes. There were no hurricanes during the year. —R.J.A.W.L.

OBITUARIES.

SIR EDWARD POULTON, F.R.S.

THE death was reported last November, at the age of 87, of Sir Edward Poulton, F.R.S., Emeritus Hope Professor of Zoology, University of Oxford. The chief interest of this, so far as Fiji is concerned, is that Sir Edward in April 1924 published a long paper in the *Transactions of the Entomological Society of London* on mimicry of certain Fijian butterflies, particularly *Hypolimnas* which mimics, or whose colours and shape make it confused with, several distasteful species of *Euploea*. By distasteful is meant their proved unpalatability to most species of butterfly-catching birds. Sir Edward was keenly interested in all aspects of insect,—especially butterfly—mimicry and their relative distastefulness to birds. To all lepidopterists home on leave from the tropics Sir Edward extended a hearty welcome at

Oxford in which city he made his home when he retired from the Hope Professorship in favour of Dr. Hale Carpenter, M.B.E., and it was there that he died last year. Sir Edward belonged to the old school of zoologists, was a staunch supporter of Darwin and had an entirely different outlook from younger men on such subjects as genetics, the affects of humidity on insects and the need of typewriters. He occupied the highest offices in the Linnean and Royal Entomological Societies and held a Swedish decoration.

—R.J.A.W.L.

MR. R. B. HOWARD.

THE death of Mr. R. B. Howard of Navua at the great age of 96 years is recorded with regret. Mr. Howard up to the end was in full possession of his faculties and was noted for his keen interest in pasture and fodder plants and for his helpful criticism. He was instrumental in introducing many useful plants into Fiji and for this service was elected an honorary member of the Fiji Society of Science and Industry.

—H.W.J.

EXTRACT.

POST-WAR EXPANSION IN FIJI.

AT the meeting of the Fiji Society of Science and Industry held on the evening of 18th October, 1943, Messrs W. J. Blackie, Senior Chemist and A. I. Biggs presented a paper entitled " Observations on Post-war Industrial Expansion in Fiji."

In their introduction, the writers pointed out that even in Fiji the Government and the people are giving thought to the problems of rehabilitation and post-war development. They considered that no sound plans for the future could overlook industrial expansion, and that such expansion should be related to our established primary industries.

They quoted the Colony's export and import figures for 1938 showing that we had favourable trade balances with the United Kingdom, Canada and New Zealand, but that if gold were ignored, our trade balances with Australia and India were adverse. It was contended that we had reached the limit of our capacity to produce our main crops of sugar, copra and bananas, due not to shortage of land, but to costs of production, quota limitations, transport costs, rivalry with other countries which have more favourable labour conditions and other causes. It is therefore necessary to endeavour to establish new crops, to establish new industries or enlarge existing ones and to make the Colony more self sufficient by ourselves producing more of our essential goods.

The Agricultural Department has already interested itself in attempts to establish new crops and has given attention to derris, tobacco, coffee, tea, tung oil, chaulmoogra and many others. Dessicated coconut, starch and candle-nut oil have also been considered. The writers held little hope for a large tea industry but considered that there were good prospects for coffee. The growing of sisal hemp was considered a means of partly offsetting one very unfavourable trade balance.

There were already notable advances in poultry and pig raising, and suggested allied industries were the manufacture of blood and bone fertilizers, meat meal, leather tanning and ham and bacon factories.

FOOD PRODUCTION.

The writers of the paper said that it seemed surprising that in a country with established dairy and cattle raising industries and with plenty of fresh fish in our waters that in 1938 the country spent something like £36,000

on canned meats, ham and bacon, condensed and powdered milk, etc., and £23,000 for canned fish. Since the war the Fijians and Indians have greatly increased their consumption of tinned meats and fish. They are also being trained to the use of leather footwear. There are skilled leather craftsmen in Fiji who could manufacture footwear from locally produced leather.

The speakers then proceeded to discuss in more detail the proposed new industries and possible expansion of existing industries. Excellent samples of leather which had been made locally with the use of tanning agents from local mangrove bark were exhibited to the audience. Samples of candle-nut oil and other oils were exhibited. Candle-nut oil has properties very similar to those of linseed oil and research shows that a candle-nut oil industry has economic prospects.

In conclusion it was pointed out that there were many advantages in the peasant farmer scheme which was being encouraged by the Agricultural Department. The scheme involved closer settlement, diversification of food crops and co-operative production, processing, and marketing of cash crops for local and overseas markets. The industrial expansion contemplated would give work to the tradesman and artisan classes. The need for more roads, bridges and improved communications generally would follow.

Although it was considered that Government should do all it could to establish any new industry, it was not suggested that any enterprise should be encouraged which could not ultimately stand on its own feet.

The writers did not consider that the present labour unrest was an unhealthy sign but rather an expression of growing perception resulting from our education progress over the last 20 years, which should be led into agricultural endeavour with the recognition of the democratic principal of a fair return for hard work.

Finally, a plea was made for the setting up of a Department of Scientific and Industrial Research. It was pointed out that in Britain and the Dominions such Departments had done invaluable service by tackling scientific and industrial problems outside the normal activities of the Government Departments devoted to scientific work.

Fiji Times and Herald, Supplement, November 22, 1943.

REVIEW.

COLONIAL ADVISORY COUNCIL OF AGRICULTURE, ANIMAL HEALTH AND FORESTRY.

WE continue in this issue some notes on a further meeting of the Colonial Advisory Council on the above subjects held last October at the Colonial Office (fifty-seventh meeting).

Subjests dealt with included principles of forest policy in the Colonial Empire and the centralization of research at the Imperial College of Tropical Agriculture, Trinidad, it being stressed that little appeared to be known of the veterinary problems in the West Indies and a detailed survey of the disease position by a competent authority was a pre-requisite to any research programme. What was wanted was to ascertain the problems peculiar to the West Indies and those that required investigating on the spot.

Turning to the wider aspect of agricultural research in the Colonial Empire it was mentioned that post-war research must be on a really adequate scale with some central planning; the difficulties were appreciated of getting the best scientists to work under existing service conditions in the Colonies.

Other subjects discussed were the future of cocoa supplies, cocoa research in the Gold Coast and comments on annual reports of certain Colonial forest departments.

—R.J.A.W.L.